

## OBSERVATIONS ON MALE BEHAVIOR OF THE EASTERN YELLOWJACKET, *VESPULA MACULIFRONS* (HYMENOPTERA: VESPIDAE)<sup>1</sup>

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**ABSTRACT:** Males of *Vespula maculifrons* patrolled conspicuous trees and bushes in an old field in southern Wisconsin. Mating behavior is described from observations of portions of five natural copulations and two copulations with a tethered queen.

Large numbers of male Vespinae flying rapidly around and between prominent vegetation (patrolling) have been previously reported for six species of *Vespula* and two species of *Dolichovespula* (MacDonald, et. al., 1974 and cited references). These are apparently mating aggregations, since the males occasionally contact and mate with females (Spradbery, 1973; MacDonald, et. al., 1974). Within the genus *Vespula* male patrolling appears to vary little among species. The aggregation and mating behavior reported here for the first time for *V. maculifrons* appear to conform to the pattern described in both *V. germanica* and *V. pensylvanica* (see MacDonald, et. al., 1974).

Observations were made from 22 September to 4 October 1978, in the University of Wisconsin Arboretum, Madison, Wisconsin. The site was an old field, 60m by 180m, containing open grassy areas with honeysuckle (*Lonicera xylosteum*), grey dogwood (*Cornus racemosa*), smooth sumac (*Rhus glabra*), black cherry (*Prunus serotina*), bur oak (*Quercus macrocarpa*), black oak (*Q. velutina*), and buckthorn (*Rhamnus cathartica*).

### Male Patrolling Behavior

Male activity was first noticed on 22 September; no activity was evident when the same area was visited on 8 and 16 September. Males were observed daily from 28 September to 4 October. On clear days activity began between 0900-0930 hrs and lasted to 1400-1500 hrs. On cloudy days activity occurred only during periods of sunshine.

Males flew around and between conspicuous trees and bushes. Around smaller trees and bushes (less than 3m tall) the males hesitated briefly, circling the plant before quickly flying on to the next tree. Around taller trees (3-10m) males flew in zigzags in all directions; most of the flight activity occurred around the upper half of the tree. More males were seen

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flying around taller trees than shorter trees. Around any one tree the number of males varied from one to approximately 50. An estimated 2000 males were present in the area. An adjacent pine stand also contained patrolling males, although not in as large numbers as in the field. No other *Vespula* species were observed patrolling these areas.

During their patrols males occasionally perched briefly on a leaf, and in some cases walked around and/or groomed before flying off. Males were not consistent in whether they faced toward or away from the tree while perched on a leaf. Perched males remained on a leaf longer from 1000-1200 hrs ( $\bar{x} = 37.75\text{s}$ ; S.D. = 24.37;  $n = 24$ ) than from 1200-1500 hrs ( $\bar{x} = 16.65\text{s}$ ; S.D. = 17.86;  $n = 20$ ) ( $t = 3.14$ ;  $0.002 < P < 0.005$ ). Grooming occurred more frequently during afternoon hours (50% of the landings) than the morning hours (37.5% of the landings). When two males perched on the same leaf, they showed no visible response toward each other. Perched males ( $n = 75$ ) never mouthed or rubbed their gaster on the leaf, suggesting no application of a pheromone.

Bumblebees, syrphid flies, conspecific males and other flying insects elicited no response from the patrolling males.

In an attempt to determine if males patrol a specific area or route (home range), twenty males were individually marked with paint (Testor's PLA) on the thorax and gaster. After marking, the males returned to the tree from which they were caught, apparently unaffected by the marking. Yet, only two males were seen again on the same tree; one the day after and the other two days after marking. The marked males were not seen during brief observations in other areas of the field. However, the marked males may have escaped my detection, due to the large number of males patrolling the tops of the trees. These observations suggest that males do not confine their patrolling to one small area (i.e., two or three trees), but either patrol the vegetation randomly or patrol large home ranges within the field.

### Mating Behavior

Portions of five natural copulations and two complete copulations with a tethered queen (gyne) were seen. The queen was tethered by tying one end of a thread (one meter in length) around her abdominal petiole and the other end to a bamboo pole. There were no obvious differences in the sequence or duration of the matings in the two situations. All observed copulations (natural and tethered) took place between 1025 hr and 1325 hr.

The full sequence of male approach through copulation was observed only with the tethered queen. The tethered queen was approached while perched on a leaf, not while in flight. The male flew in a zigzag fashion, downwind from the queen, for less than 30s, gradually flying closer and finally landing on the leaf next to the queen. He then antennated the queen

and climbed, with his claspers extended, onto her gaster from behind. The male then climbed onto her thorax and coupled with her. Approximately 20s after coupling was established the male flipped backwards venter up and fanned his wings. If the queen clung to the underside of the leaf, the male hung in mid-air, or if the queen sat on top of the leaf, the male laid back on the leaf. The male then groomed his forelegs with his mouthparts, while occasionally the queen groomed her forelegs and mouthparts. Grooming lasted 4 min. and 7.58 min. in the two tethered situations. The complete phase of male fanning was not seen in two natural pairings, but the portions seen lasted 58s and 4.42 min. In all copulations the queen then turned ventrally and bit the male's tergites while the male continued to fan his wings. This phase lasted 2 min. and 1.35 min. in tethered pairs and 2.2 min. and 13.45 min. in natural pairs. The male then released the queen and immediately flew away. Under natural conditions the queen flew out of the area 24s later and in another situation, after being pounced on by another male, 35s later.

During the copulations other males (10-15) flew within one meter of the pairs, but did not approach or respond to them in any way.

## Discussion

*V. maculifrons* patrolling behavior is similar to male behavior of *D. sylvestris* (Sandeman, 1938), *D. norvegica* (Wynne-Edwards, 1962), *V. austriaca* (Pack-Beresford, 1901), *V. rufa* (Spradbery, 1973), *V. vulgaris* (Schremmer, 1962), *V. germanica* (Thomas, 1960; Schremmer, 1962), *V. atropilosa* and *V. pennsylvanica* (MacDonald, et. al., 1974). In all cases males patrol among conspicuous objects, with no evidence of a male marking pheromone.

In all vespine species, except *V. atropilosa*, in which it has been observed, male behavior during copulation appears to be similar. *V. atropilosa* males, under caged conditions, frequently initiated mating in mid-air and remained coupled with the queen for shorter durations of time than the other above species, apparently because of continual harassment from other males (MacDonald, et. al., 1974).

It is thought that the biting behavior of the queen may stimulate the male to release her (Richards, 1937). In *V. maculifrons* this behavior also gives the impression that the queen is trying to escape. This difficulty in uncoupling may function to protect against usurpations by other males. However, since other males apparently do not attempt to usurp copulating males (except for males of *V. atropilosa*), it may be considered a form of post-copulatory guarding (see Parker, 1970, 1974). Queens are known to mate more than once in cages (MacDonald, et. al., 1974) and while

tethered (see above) and occasionally another male may attempt to grasp the queen immediately following copulation (see above). A second mating may result in sperm competition and eventual precedence of the second male's sperm over the first male's, suggesting a possible advantage for male guarding (Parker, 1970, 1974). The male, by retaining his hold on the female for a relatively long duration (1.35 to 13.45 min.) facilitates remaining with the queen until she is likely to fly out of the field, away from possible mates.

#### ACKNOWLEDGMENTS

I thank Robert L. Jeanne, Robert W. Matthews, and Ronald L. Rutowski for suggestions on improving the manuscript.

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